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ACIDIMETRIC ESTIMATION OF VEGETABLE ALKALOIDS.

A STUDY OF INDICATORS.

BY LYMAN F. KEBLER.

That this method seems intangible and unsubstantial to some minds, probably supplies the firmest grounds for hopeful anticipations concerning its future perpetuity. A new method is not propounded and established in a day, springing into existence completely armed, like Minerva from the head of Jupiter, or adorned in all its beauty like Venus from the foam of the sea. As chemistry is the offspring of physics or the science of molecules, which in turn was developed from mechanics or the science of masses, so titration of alkaloids with volumetric acid solutions has been evolved from the study of the basicity of alkaloids on the one hand, and the behavior of alkaloids with indicators on the other.

The method appears to have sunk into a state of quiescence from time to time, for as early as 1846 M. Schlössing¹ proposed the method and applied it to the titration of nicotine with a view of establishing its equivalent; using sulphuric acid and litmus in his work.

Sixteen years later the work was taken up by Wittstein,² who was followed by F. M. Brandl,³ Liecke,⁴ Kosutany⁵ and G. Dragendorff.⁶ Up to this time, nicotine and coniine were the only alkaloids operated on, and litmus the only indicator employed. In 1879 L. van Itallie⁷ extended the work to several other alkaloids, using lacmöld as indicator. A. W. Gerrard⁸ a few years later employed

¹ Numerical references at the end of the article.

litmus and phenolphthalein in titrating the alkaloids of belladonna. From the contributions of O. Schweissinger,⁹ who used cochineal as indicator, E. Dieterich¹⁰ and P. C. Plugge,¹¹ dates the impetus titration of alkaloids with volumetric acid solutions received at the beginning of the present decade.

The method had been gaining ground rapidly when several most valuable communications appeared by C. C. Keller,¹² of Zürich, since which gigantic strides have been taken.

In volumetric analysis the first question demanding attention is a suitable indicator of delicate end reaction. The object^a of this communication is to present the results of a study of five indicators in titrating alkaloids, thinking, perhaps, it might be of some service in formulating systematized methods of analysis in alkaloidal chemistry. The discordant results of analysis often obtained by different chemists operating on the same sample are greatly to be regretted. It is the writer's candid opinion that the discrepancies are chiefly due to differences in *modus operandi*, defective apparatus, and in volumetric analysis different end reaction tints, arbitrarily assumed by each worker.

In order to eliminate the factors of uncertainty as completely as possible, the methods of operation were carefully written out and closely adhered to in all the work. The burettes and a pipette were carefully calibrated in order to ascertain the necessary factor for correction. The method of calibration was as follows: each burette and pipette was exactly filled to the zero mark with distilled water, at 15° C., and 10 c.c. delivered into a tared weighing flask and weighed; then the next 10 c.c. were treated in the same manner, and so on until the entire capacity of each was tested. A glass-stoppered cylinder was also standardized. All efforts to standardize a litre flask were thwarted. A large balance, sufficiently sensitive to do the work satisfactorily, could not be found.

In titration the personal equation plays an important part. Authorities are not agreed on end reaction tints, each operator relying on his own judgment. The writer thinks it correct to titrate to the point where a different color from the initial one is developed. In order to obtain standard end reaction tints, it will

^a Alkaloids, generally, are neutral to phenolphthalein, consequently it cannot be employed in titrating alkaloids directly. It is available for indirect titrations, *i. e.*, estimating the amount of acid combined with an alkaloid in its neutral salts.

be necessary to prepare some absolutely pure alkaloid; treat a molecular quantity of the alkaloid with an equivalent of the acid in question to form a neutral salt, then add one drop more of the decinormal acid for an acid color reaction. For alkaline tints add one drop of the centinormal alkaline solution to a solution of neutral salt, theoretically prepared.

In this work the writer titrated from acid to alkaline solutions as follows: Brazil wood, from yellow to onion-red, the purple ultimately fading to this; cochineal, from yellow to bluish-red; hæmatoxylin, from yellow to brown-orange; litmus, from red to onion-red, and methyl orange from red to straw-yellow.

The indicator solutions were prepared according to the most approved processes. Cochineal and litmus were prepared according to the specifications of Sutton's volumetric analysis, sixth edition. Phenolphthalein, 1 gramme dissolved in one liter of 50 per cent. alcohol. Hæmatoxylin, well crystallized, 1 gramme dissolved in 100 c.c. of strong alcohol. The method best suited for preparing the Brazil-wood solution, is to place 3 grammes of the wood into a casserole, add 10 c.c. of distilled water, boil gently for a few minutes, cool and filter. A freshly prepared solution has given the writer the most satisfactory results. Methyl orange, 1 gramme dissolved in 1 liter of distilled water. Considerable difficulty was experienced in obtaining even a fairly satisfactory product of methyl orange. The method proposed by Mr. B. Reinitzer,* for preparing the litmus solution, did not come to the writer's notice until considerable work had been done with the solution prepared as above.

In titration, the following quantities of the several indicators were employed; methyl orange, Brazil wood, cochineal and phenolphthalein, 5 drops each; litmus, 10 drops, and hæmatoxylin, 3 drops.

The standard solution employed in this investigation, from which the exact strength of the other volumetric solution was determined, was a solution of normal sulphuric acid. This solution was prepared from data obtained by the several methods; titration against pure anhydrous sodium carbonate, using the above indicators; precipitation as barium sulphate, and Weinig's^b process. After some experi-

* 1894, B. Reinitzer, *Zeit. f. angewand. Chem.*, 547 and 573; *Chem. News*, 70, 225, 239 and 249.

^b 1892, *Zeit. f. angewand. Chem.*, 204; *Analyst*, 17, 99.

mentation, it was found that Weinig's method gave the most satisfactory results. The following are the data obtained from an approximately normal sulphuric acid solution with the above methods :

Methods,		Number of c.c. of Acid Solution required per 10 c.c. of Normal Sodium Carbonate.	Grammes of SO_2 in 10 c.c. of the Acid Solution.
Sodium Carbonate.			
Indicators.	Brazil wood	9.50	0.4211
	Hæmatoxylin	9.54	0.4192
	Cochineal	9.50	0.4211
	Litmus	9.50	0.4211
	Methyl orange	9.50	0.4211
	Phenolphthalein	9.45	0.4216
	Weinig's method	—	0.4247
Barium sulphate method .		—	0.4200

Due precaution was taken to boil the solution thoroughly with the indicators requiring it. With solutions of the above strength it was impossible to detect any difference in the sensitiveness of most of the indicators.

With the normal sulphuric acid solution a normal solution of pure potassium hydroxide was standardized. From the normal sulphuric acid solution and normal alkaline solution there were prepared, respectively, a decinormal acid solution and a centinormal alkaline solution. The two solutions thus prepared were carefully titrated against each other, employing the above indicators with the following results :

Indicators.	Number of c.c. of Normal Sulphuric Acid.	Number of c.c. of N-100 KOH required per 10 c.c. of N-10 H_2SO_4 .	
		La Wall.	Kebler.
Phenolphthalein	10	101.80	102.00
Brazil wood	10	99.56	100.00
Cochineal	10	100.58	99.80
Hæmatoxylin	10	99.76	100.00
Litmus	10	99.97	99.60
Methyl orange	10	92.67	98.53

My associate, Mr. La Wall, took up a portion of the work, which he executed independently, using, however, the same solutions and apparatus that the writer employed. The above and all subsequent results are the average of duplicate, triplicate or more titrations.

The titration of pure alkaloids, as found in the market, was next undertaken. With quinine and codeine the following method was used: two grammes of the alkaloid were placed into the cylinder, dissolved in alcohol and diluted up to 100 c.c. with alcohol. To 10 c.c. of this solution and the requisite quantity of indicator, contained in a suitable beaker, the decinormal acid solution was added to slight excess, agitated, allowed to stand a few minutes, the sides of the beaker well washed down with distilled water, adding about 40 c.c., and the excess of acid titrated back with the centinormal alkaline solution.

With alkaloids not freely soluble in alcohol, the following procedure was adopted: two grammes of the alkaloid were placed into a 200 c.c. beaker, 75 c.c. of decinormal acid added, the contents of the beaker warmed on a water bath and occasionally agitated until the alkaloid was dissolved. The beaker and contents were then cooled, the contents transferred to a 100 c.c. cylinder, the beaker carefully rinsed with several successive portions of water, transferred to the 100 c.c. cylinder, and finally made up to 100 c.c. with water. Each 10 c.c. contained 0.2 grammes of alkaloid and 7.5 c.c. of decinormal acid solution. After adding the requisite amount of indicator to 10 c.c. of the alkaloidal solution, and diluting up to about 50 c.c., the excess of acid was carefully retitrated. Two or more titrations were made in every case, with the same solution and indicator, by adding to the solution just finished another portion of decinormal acid solution and retitrating with the centinormal alkaline solution, taking finally the average reading.

The above methods of titration and preparation of solutions were

Indicators.	Quinine. La Wall.	Quinine. Kebler.	Strychnine. Kebler.	Morphine. Kebler.	Codeine. Kebler.
Brazil wood	99'90	101'97	99'36	98'93	95'75
Cochineal	105'56	102'54	103'20	99'08	97'09
Hæmatoxylin	99'81	103'37	100'03	98'17	95'90
Litmus	101'80	103'55	103'54	98'93	96'38
Methyl orange	—	123'27	104'21	100'59	98'11

employed with several pure alkaloids. The results are tabulated at bottom of the preceding page.

The number of times the analyst is requested to investigate the purity of refined alkaloids is comparatively small, but the crude alkaloids claim a greater share of his time and attention.

The next step was to investigate the adaptability of the above process to crude morphine and crude cocaine.

Indicators.	Crude Morphine. La Wall.	Crude Morphine. Kebler.	Crude Cocaine. Kebler.
Brazil wood	99'23	98'47	95'90
Cochineal	100'14	99'53	97'11
Hæmatoxylin	99'08	97'59	95'74
Litmus	99'50	98'93	96'82
Methyl orange . .	102'10	100'02	100'14

With the same crude morphine the ash method yielded 97'59 per cent.; the lime-water method 98'22 per cent., and the absolute alcohol method 98'33 per cent. of pure morphine.

A complete analysis was made of the crude cocaine, to ascertain how nearly the titrations corresponded with the gravimetric process of Dr. Squibb.*

	Per Cent.
Moisture	0'405
Cocaine, nearly pure	97'300
Material soluble in ether	0'100
Material insoluble in ether	1'810
Loss	0'385
Total	100'00

Notwithstanding the fact that crude alkaloids claim considerable attention on the part of the analyst, yet only a few are found already extracted on the market. It generally happens that the operator is requested, not only to determine the amount of pure alkaloids, but also to extract them from their natural sources. For this purpose the writer employed a modification of Keller's process. The method is as follows: place 10 grammes of the dry drug into a 250 c.c. flask, add 25 grammes of chloroform, 75 grammes of ether, stopper the flask securely, agitate well for several minutes, add 10 grammes of

* Ephemeris, 3, 1, 171.

10 per cent. ammonia water, then agitate frequently and during one hour. On adding 5 grammes more of 10 per cent. ammonia water and shaking well, the suspended powder agglutinates into a lump, the liquid becomes clear after standing a few minutes and can be poured off almost completely.

A. When the mixture has completely separated, pour off 50 grammes into a beaker, evaporate the solvent on a water bath, add 10 c.c. of ether and evaporate again. Dissolve the varnish-like residue in 15 c.c. of alcohol, with heat, add water to slight permanent turbidity, the requisite quantity of indicator and an excess of the acid solution; retitrate with the centinormal alkaline solution.

Indicators.	La Wall.	Kebler.	La Wall.	Kebler.	La Wall.	Kebler.	La Wall.	Kebler.
	Per Cent. of Alkaloids in Nux Vomica by Process A.		Per Cent. of Alkaloids in Nux Vomica by Process B, Gravimetrically.		Per Cent. of Alkaloids in Nux Vomica by Process B, Volumetrically.		Per Cent. of Alkaloid in Ipecac Root by Process A.	
B. W.	2'04	2'58	2'04	3'00	2'37	2'37	2'46	2'54
C.	2'64	2'69	2'86	3'10	2'42	2'39	2'52	2'49
H.	2'18	2'24	2'88	3'11	2'23	2'27	2'48	2'54
L.	2'38	2'34	2'03	3'05	2'55	2'37	2'55	2'57
M. O.	3'02	3'64	2'93	3'02	2'65	2'61	2'95	3'30
	Per Cent. of Alkaloid in Ipecac Root by Process B, Gravimetrically.		Per Cent. of Alkaloid in Ipecac Root by Process B, Volumetrically.		Per Cent. of Alkaloids in Belladonna Leaves by Process B, Gravimetrically.		Per Cent. of Alkaloids in Belladonna Leaves by Process B, Volumetrically.	
B. W.	2'58	2'60	2'36	2'35	0'26	0'20	0'19	0'15
C.	2'63	2'58	2'52	2'33	0'28	0'20	0'24	0'14
H.	2'58	2'68	2'35	2'33	0'27	0'22	0'21	0'13
L.	2'62	2'60	2'40	2'25	0'24	0'18	0'20	0'15
M. O.	2'66	2'63	2'89	2'61	0'25	0'20	0'23	0'20

NOTE.—B. W. = Brazil Wood, C. = Cochineal, H. = Hæmatoxylin, L. = Litmus, and M. O. = Methyl Orange.

B. When the mixture has completely separated, pour 50 grammes into a separatory funnel, treat at once with 20 c.c. of acidulated water; after thorough agitation and complete separation, remove the aqueous solution into a second separatory funnel. Repeat the above operation twice more successively with 15 c.c. of slightly acidulated water. The acidulated water in the second separatory funnel is rendered alkaline with ammonia water, the alkaloid removed, successively, with 20 c.c., 15 c.c., and 15 c.c., of a mixture of three parts (by volume) of chloroform and one part of ether.

Collect the chloroform-ether mixture in a tared beaker, and distill off the solvent. The varnish-like residue is twice treated with 8 c.c. of ether, evaporated on a water bath and dried to constant weight on the water bath. The varnish-like residue is dissolved in 15 c.c. of alcohol and treated as in *A* above.

Nux vomica and ipecac root were treated according to processes *A* and *B*; belladonna leaves according to process *B*.

According to the well-established method of Messrs. Dunstan and Short, the nux vomica examined contained 2.89 per cent. of crude alkaloid. On carefully titrating this crude product with a volumetric acid solution, 2.12 per cent. of pure alkaloid was indi-

Indicators.	Per Cent. of Alkaloids in Fluid Extract of Nux Vomica by Process <i>A</i> .		Per Cent. of Alkaloids in Fluid Extract of Nux Vomica by Process <i>B</i> , Gravimetrically.		Per Cent. of Alkaloids in Fluid Extract of Nux Vomica by Process <i>B</i> , Volumetrically.	
	La Wall.	Kebler.	La Wall.	Kebler.	La Wall.	Kebler.
B. W.	1'62	1'70	2'02	2'00	1'70	1'61
C.	1'77	1'76	1'97	2'01	1'74	1'64
H.	1'61	1'67	2'01	1'96	1'58	1'50
L.	1'69	1'72	2'02	1'94	1'59	1'55
M. O.	2'01	1'92	2'01	1'94	1'92	1'82
	Per Cent. of Alkaloid in Fluid Extract of Ipecac Root by Process <i>A</i> .		Per Cent. of Alkaloid in Fluid Extract of Ipecac Root by Process <i>B</i> , Gravimetrically.		Per Cent. of Alkaloid in Fluid Extract of Ipecac Root by Process <i>B</i> , Volumetrically.	
	La Wall.	Kebler.	La Wall.	Kebler.	La Wall.	Kebler.
B. W.	1'74	1'78	1'75	1'86	1'67	1'67
C.	1'79	1'80	1'76	1'80	1'72	1'72
H.	1'77	1'86	1'74	1'74	1'65	1'65
L.	1'74	1'74	1'73	1'80	1'66	1'60
M. O.	2'00	1'95	1'74	1'79	1'92	1'88

cated. Cochineal was used as indicator. These figures show that this method produces an alkaloidal residue containing a smaller percentage of pure alkaloid than that obtained by Keller's process.

The writer's attention was next directed to the fluid extracts of nux vomica and ipecac root, whose alkaloids were extracted as follows: place 12 grammes of the extract into a 250 c.c. flask, dilute with 12 grammes of distilled water, agitate well, then add 30 grammes of chloroform and 90 grammes of ether, stopper the flask securely and shake well. Add 6 grammes of 10 per cent. ammonia water, and agitate the mixture frequently during half an hour.

* 1883, *Pharm. J. Trans.* (3), 13, 665.

Allow the mixture to separate completely. Treat 50 grammes of the chloroform-ether mixture according to processes *A* and *B*.

The great difficulty with a number of the processes in vogue is the formation of obstinate emulsions. Of the many assays made by the above process, not more than one per cent. formed emulsions. The results were obtained with *nux vomica* and *ipecac*, as shown in chart on opposite page.

From the results embodied in this paper it can safely be concluded that methyl orange cannot be numbered with the indicators suitable for titrating alkaloids. It fails to give satisfactory results with N^{100} , N^{50} , and stronger solutions. Notwithstanding the sensitiveness claimed for methyl orange, the writer believes that its days, as an ideal indicator, are numbered. Even Prof. Lunge, the staunch advocate of methyl orange, has admitted that a properly prepared solution of litmus is quite superior to this indicator in inorganic titrations.

A solution of litmus, prepared according to the directions herein employed, is quite unsatisfactory for delicate titrations. The method proposed by Reinitzer promises to be better suited.

Of the indicators thus far considered, hæmatoxylin, Brazil wood and cochineal give very promising results. Hæmatoxylin justly claims first place, and Brazil wood second. Other indicators will be considered in due time.

As stated above, the prime object of this investigation is to ascertain what indicators are best adapted to the titration of alkaloids; but in order to determine how reliable the results were, gravimetric determinations necessarily formed a part of the work.

When it is remembered that not only do analytical methods contain inherent limitations, but also that each operator possesses a positive or a negative equation of error, the reader will undoubtedly concur with the writer that the results are very satisfactory. Attention must again be called to the fact that the work was conducted under precisely the same conditions.

As would naturally be expected, the amount of alkaloid obtained by process *B* is smaller than that secured by process *A*. A small per cent. of the alkaloid may be lost during the process of extraction; the small amount of coloring matter possibly vitiates the results, or perhaps some non-alkaloidal substance increases the yield.

From the hundreds of assays made by the author, he feels justified in stating that all of the gravimetric processes yield products con-

taining considerable non-alkaloidal matter, and hopes that the day is not far distant when all gravimetric results will at least be supplemented by volumetric methods if not displaced by them.

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305 CHERRY STREET, PHILADELPHIA, PA.

MINERAL WEALTH OF SOUTHERN STATES.

BY WILLIAM B. THOMPSON.

Mr. H. C. Demming, formerly State Stenographer, a gentleman well known and much esteemed by the druggists of Pennsylvania, whom, in the deliberations of the Pennsylvania Pharmaceutical Association, he has frequently served in his professional capacity, writes to the *Philadelphia Times*, under date of August 19th, a highly interesting account of the unusual mineral development of a region embraced in Virginia, the Carolinas and Georgia. Almost every known production of mineral has been found, including such rare gems as the diamond and ruby. A conclusion naturally suggested by the statements of Mr. Demming is that we have become so accustomed to the figures and statistics of the enormous soil products of this country, as well as its staple mineral and metal resources, that we have yet to realize the wealth of that which lies hidden in its vast geological formation. The interest of the student must be awakened to the future importance of these products to science and art. As an illustration of the latter adaptation, reference may be made to the group which includes corundum, zircon, and monazite, the last of which now enters largely into the composition used in the Welsbach light and other similar purposes, both in the United States and Europe. Monazite appears to be a highly composite mineral, and in a conglomerate state has been sold from the mine in quantity as great as five tons per day, at \$200 per ton. It is valued for containing such associate substances as thorium, cerium, didymium, rhodium, lanthanum and yttrium. "Two per cent. of thorium," Mr. Demming says, "makes monazite a very salable mineral in Europe," whilst he also states that he has found in good specimens of this mineral as high as 27 per cent. of cerium oxide. The number and variety of precious stones and minerals which have been found exceeds thirty, including almost every known kind. Many of these, when set and polished, are of great natural beauty, and of sufficient character to attract the notice of the lapidary. The particular interest, however, which these facts furnish to pharmacists may be found in the adaptation of some of these more rare mineral specimens to the purposes of therapy and bacteriology. Investigators in England, France and Germany are, at the present time, engaged in determining certain properties which are supposed to pertain to these, naturally, and as bases for compounds

and chemical salts. It is well known that minerals which, in their natural or crude state, prove toxic to animals when chemically or otherwise combined, are found to be highly useful as prophylactics against the poison of germs and bacilli, causes assigned by modern theory as the origin of phthisis, diphtheria, cholera and variola. If such should prove to be well established, the *new* South will assume a greater interest, and her soils yield a deposit of greater value to mankind and to human science than can be estimated or computed by money value. The letter of Mr. Demming will amply repay a most attentive perusal.

PHILADELPHIA, August 28, 1895.

A SUGGESTION OF A USE FOR THE RARE METALS.

BY HENRY C. DEMMING.

Microbes are coming to the front in pharmacy. The day is not far off when the skilled pharmacist will find it necessary to have a good microscope, as well as much knowledge of botany. But he will not be able to stop there. Scientific research now demonstrates that pharmacy may soon require mineralogy as a handmaid to botany. The reason of this is apparent to any one who has kept abreast of the strides of the most eminent scientists of our day. Several very learned and able men found the microbe which exists in disease; and others, notably Professor Koch, found the microbe that exists in pulmonary diseases. Some other scientific mind or minds found that bacteria belong to the vegetable kingdom; at least, that is claimed by able investigators just now.

Then, patient investigation has led to the discovery of different families of bacilli. For instance, one species is dominant in pulmonary diseases, another in diphtheritic cases, another in scarlet fever, another in smallpox, and still another—more attenuated—in Asiatic cholera. Possibly membranous croup has its peculiar bacterium, but I believe that has not been definitely ascertained. Neither has it been ascertained, as yet, the peculiar species which may exist in cases of aggravated diphtheria. The molecular disintegration of the cellular tissues of the brain possibly has its own peculiar family of bacteria, and even earache may be traceable to a distinct species.

Then, further patient research—and I think much of this is due to the labors of C. A. Mitchell—has led to the publication of the fact that there are, at least, seventy distinct species of color-producing

bacteria, many of which are perfectly harmless to man. The bacteria discovered in the corners of the mouth of a healthy person, though extremely poisonous and dangerous in certain conditions, can be classed usually with the harmless varieties.

But, before I go into deeper water—and perhaps I ought not to go deeper in an article at this time—it has been made manifest that these different colored micro-organisms require different treatment, to lead to their annihilation. The several species capable of throwing off a reddish coloring matter—from the faint pink to the deep blood-red—may require quite different treatment to lead to their destruction than would be required for bacteria producing a blue color—from the light slate-blue to the deep blue color of the thousand-fathomed sea. So with the green, the violet and the brown, as well as the other colors.

Some labor will have to be spent in determining accurately which are injurious to human life, and which are harmless in health; then to determine which become harmless to one apparently healthy, and incapable of enduring much exposure. Then comes the task of determining which are most injurious when disease appears, when disease is well under way; and how the microbes are to be treated, if treated at all, when the disease has shown signs of conquest.

In these investigations it has already been clearly demonstrated that the products of the botanical world are futile, no matter how administered, when certain microbes appear. Dr. Meade Bolton, in England, followed out some experiments which had previously been carried on by others, until he realized that there are certain metals which are capable of destroying microbes in contact with them. He cultivated certain species in jelly, spread upon a plate; and bits of metal were dropped upon the jelly while it was still moist. He found that any metal that could arrest the development of microbes destroyed them; not only those which came in direct contact with the metal, but other microbic life for a narrow space around the metal. This potentiality varied, not only with the kind of metal, but with the species of microbes. He found that pure gold produced no effect; neither did pure nickel, nor platinum, nor a few other metals that he tried. But copper, zinc and silver were effective in some instances, though cadmium acted quickly and effectively in almost, if not, every instance. The learned doctor observed that the metals which affect the microbes were those that

are readily attacked by chemical reagents, while those that resisted such reagents, like gold, had no effect. He concluded that the action upon the organisms was due to the solution of the metals taking place in the jelly.

But what a wide field he has opened!

Here is a world for exploration, with promise of rich reward. You have many readers of an investigating turn of mind. Many of them have their own private microscopes, and bacteria are to be found on every hand in abundance. Metals of some description are on every shelf. Who will be the first to discover that some other metal than cadmium is destructive of the peculiar species of bacteria so prevalent in serious cases of scarlet fever; and then how many diseases, with their peculiar species, there are in this wide world of disease and death?

It may be necessary, in conducting these experiments, to resort to many species of the rarer minerals, and to reduce these species to metals and solutions. But we have the young men who have the ability, the skill, the patience and the time to solve the important problems.

The question may arise where to obtain the metals or minerals. Having given this subject much special study during the past fifteen or twenty years, perhaps I can supply the key whereby any known mineral or metal can be provided when wanted. It is a remarkable fact that when a so-called rare metal is required for commercial use, that somebody, somewhere, will, in a comparatively short time, be able to supply the article.

Take our Welsbach light, manufactured at Gloucester, N. J. When the manufacture was first attempted in the United States, the officers of the Welsbach Company sent out letters in every direction for minerals containing the metals they wanted. They had to experiment some time before they really made much headway; then they concentrated on one or two minerals—one known as monazite. Then the problem: Where can this mineral be found in sufficient quantities to enable the company to supply the growing demand for their manufacture? At first they met with very moderate success—perhaps some people would have pronounced it failure. But they kept on; and now they can purchase all the monazite they require, either from North and South Carolina, or Brazil, with small quantities now and then from other localities.

A number of years ago Mr. Thomas A. Edison wanted one or two rare minerals for his purposes. At first they could not be supplied satisfactorily; but, as the demand grew, the product increased, and now the tip of every phonograph receiver has a sapphire point, and the mineral itself is supplied at fabulously low prices. A party in France wanted zircon for their establishment, and it seemed at first that they never could obtain enough; but a gentleman in North Carolina mined and shipped them 600 pounds, a larger quantity than had ever before been found, and an abundant supply for their purposes. But the uses of zircon have since multiplied. The product has multiplied also, and now it is not an unusual thing to hear of a whole carload of this once rare mineral being shipped.

Returning to monazite—which is a mineral containing cerium, didymium, erbium, lanthanum, thorium and yttrium. Here are rare metals, varying in price from \$10 to \$360 a pound. If any of them should be found wholly efficient in destroying any species of bacteria, there is no doubt that the metal would be forthcoming in any quantity necessary to meet the demand of the medical world. As proof of this I am now mining and shipping to Europe many thousands of pounds of the mineral from which these metals are derived, and have no fear that I shall not be able to fill any order which comes along not exceeding a thousand tons.

Other very rare metals exist in monazite, and also in samarskite—in the latter such rare species as columbium, terbium, decipium, tantalum, argon and helium, some of which are possibly entirely unknown practically to many chemists, as well as those engaged in other sciences.

Euxenite, another very rare mineral, also contains rare metals, such as germanium and uranium, as well as argon and helium. Antidotes of the poisons of these various bacilli cannot be said to have no existence until these various metals have been tried. Then arises another difficulty, to be swept away, if possible—the use of a metal to destroy certain micro-organisms, and the metal itself to be non-injurious to the human body. That this will lead to much experimenting, there is no doubt; but, of course, none of the first experiments should be made on human beings, no matter how aggravated the case.

Referring again to euxenite, samarskite, and the element helium, derived therefrom, when helium has been utilized to produce arti-

ficial sunlight—for the sun contains helium—then we will have a light to experiment with far in advance of the electric bulb now placed in the human stomach for the purpose of clinical and other observations; and when helium is put into further practical use, we will also have something to work by in our laboratories that will be akin to sunlight, and thus save many a sweltering and many a headache now caused by modern artificial lights.

Acting upon the discoveries of Dr. Meade Bolton, the searcher for that which will lengthen human life by destroying disease will most likely be guided by the cue, given by the doctor, that the metals most readily attacked by chemical reagents are most effective in the destruction of microbial life. A comparatively short investigation will enable the student or the searcher after this knowledge to make a list of the metals required. Possibly, most of the metals on the list can be obtained at once and with little difficulty. But when the others are desired I would suggest that they be sought through parties skilled in obtaining them, either in the United States or abroad, and I believe it is now conceded that every known mineral and metal has been found in the United States, and by far the largest number in Virginia, North Carolina, western South Carolina, Georgia, Alabama and eastern Tennessee. Only a short time ago, in an area of less than five square miles, I found and classified 138 species of minerals, more than half of them of the rarer varieties. I believe it is possible to make even a longer list, and that the locality I refer to is not the only place in the United States where so many can be found.

It is quite evident, then, that when an antidote is found, the mineral will be forthcoming in ample quantities to make the antidote effective and widespread.

It seems to the writer that all these medicinal elements for the restoration to health of bacteria-troubled patients is right in the line of advanced pharmacy. Being in that line, why ought not the pharmacists of this country to be first to make efforts in the way where they will naturally travel ere long? I shall watch with keen interest any steps taken by the pharmaceutical world in the direction pointed out in this article.

HARRISBURG, PA., September 12, 1895.

REPORT ON TANNIN FROM AN EXUDATION OF *PTEROCARPUS DRACO*, LINNÉ,¹ AND KNOWN IN JAMAICA AS DRAGON'S BLOOD.

BY HENRY TRIMBLE.

The origin of this product was described in the *Bulletin of the Botanical Department*, Jamaica, No. 45, July, 1893.² As there stated the tree is about thirty feet high, and when an incision is made in the bark, drops of red sap ooze out, which flow slowly down the bark and gradually harden.

The sample received by me from Mr. Fawcett was in small garnet-red pieces, transparent at the edges, and breaking with a resinous fracture. It much resembled the eucalyptus kino received from Australia.

On account of its solubility in water the product closely resembled some other varieties of kino, as well as the one just mentioned from Australia.

Warm water dissolved 95.95 per cent. of it; the insoluble portion, 4.05 per cent., consisted chiefly of adhering bark fibre.

The ash amounted to 2.36 per cent., and was found to consist of potassium, calcium, magnesium, and sulphuric, carbonic and phosphoric acids. There were found 34.85 per cent. of tannin and 25.40 per cent. of moisture, which would indicate 46.71 per cent. of tannin in the absolutely dry substance. The balance consisted chiefly of gum. A complete statement, therefore, might be made as follows:

	Per Cent.
Tannin	34.85
Moisture	25.40
Ash	2.36
Insoluble	4.05
Gum, etc.	33.34
	<hr/> 100.00

The tannin was separated from the gum with great difficulty, because of the ready solubility of each in water, and because the tannin caused some of the gum to go into solution in absolute alcohol, and also in a mixture of alcohol and ether. Agitation of the water

¹ From the *Bulletin of the Botanical Department*, Jamaica, Vol. 11, p. 161.

² A history of this substance was given by Flückiger, *Pharmaceutical Journal*, 1893, p. 108, and *Am. Jour. Pharm.*, 1893, p. 460.

solution with acetic ether, even in the presence of salt, did not serve to separate the tannin from the gum, as the latter substance seemed to withhold the former. The close association of the two principles was finally broken up to some extent by agitation of the coarsely powdered sample with sand and acetone. Upon allowing the mixture to rest, the gum separated as a jelly-like mass. The acetone solution when separated, and the solvent recovered by distillation, left the tannin in a porous condition, but still admixed with some gum. From this residue the greater part of the still adhering gum was separated by treatment with absolute alcohol. The solution was filtered from the gum left undissolved by that solvent and distilled to dryness, and the residue rendered porous by solution in a mixture of alcohol and ether and subsequent rapid vaporization of those solvents by distillation under reduced pressure.

The ultimate composition of the pure tannin will be seen by the following average of three analyses :

	Per Cent.
Carbon	58.91
Hydrogen	4.80
Oxygen	36.29
	<hr/>
	100.00

An aqueous solution of the tannin gave the following reactions :

- Lime water Purplish-pink color, becoming a brownish ppt.
- Bromine water Yellow ppt.
- Ferric chloride Green ppt. and color.

The composition, as well as the reactions, indicate it to be very closely related to oak bark tannin, if not identical with it. The sample does not agree in composition or properties with the dragon's blood from the East Indies ; it does, however, closely resemble the kinos, and should more properly be classed with them.

It will, no doubt, if found in sufficient quantity, have some use in medicine as a kino, and it might be used, in case its price should warrant it, in the manufacture of leather, although such substances containing gum usually make a soft product.

ABSTRACTS FROM THESES.

Contribution from the Chemical Laboratory of the Philadelphia College of Pharmacy. No. 147.

KOLA.

Nathan L. Thompson, Ph.G., estimated the total alkaloids and the tannin of some specimens of this drug which he obtained in commerce. He applied three methods for extracting the alkaloids. In the first, these principles were extracted from the powdered or finely chopped nuts by maceration with chloroform, purified by treatment with acidulated water and removed from the liquid, which was filtered from the greenish-yellow fatty substance that separated, by rendering it alkaline with sodium hydrate and agitating it with chloroform. The second method consisted in exhausting the drug with 2 per cent. hydrochloric acid, and, after making alkaline with sodium hydrate, removing the alkaloids with chloroform. Lloyd's process with ferric hydrate was employed as the third means of estimation. The crystals of the alkaloids

Specimen.	Condition.	Moisture.	Ash.	Tannin in	
				Original Drug.	Absolutely Dry Drug.
1	Dry	7.55	3.19	1.73	1.87
2	"	6.95	2.20	1.73	1.86
3	Fresh	56.65	3.66	1.24	2.85
4	Partly dried	38.50	3.66	1.52	2.47

TOTAL ALKALOIDS.

Means of Extraction.	Specimen.							
	Original Drug.				Absolutely Dry Drug.			
	1	2	3	4	1	2	3	4
Chloroform	1.00	.55	.80	.75	1.08	.59	1.84	1.22
Acidulated water . . .	1.35	.75	.85	1.00	1.46	.80	1.96	1.62
Lloyd's process	1.35	—	.75	—	1.46	—	1.73	—

which were weighed in these estimations were pure white in color. The tannin was estimated by the gelatin and alum method. The results are given in percentages on the preceding page.

FLUID EXTRACT OF CUBEB.

Percy Hyers, Ph.G., determined the total solids, oil and fatty matter and resin contained in some samples of this preparation which he purchased in the market. The total solids were estimated by evaporating a known weight. An examination of the residues proved the absence of glycerin. To separate and estimate the oil and fatty matter, a quantity of the fluid extract was diluted with five volumes of acidulated water, and this mixture shaken with several successive portions of petroleum ether. After this treatment the mixture was agitated with ether to remove the resin. He also prepared a fluid extract in strict accordance with the official directions, and examined it in the same manner. The results were the following percentages :

	Total Solids.	Color of Residue.	Oil and Fatty Matter.	Resin.
1	15.30	Brownish-green	11.92	4.22
2	14.30	Green	7.86	3.98
3	13.85	Dark brown	7.60	4.06
4	11.97	"	8.90	4.08
Own	20.85	"	13.70	4.40

The author found that ether extracted 22.45 per cent.; acetone, 18.48 per cent.; alcohol, 14.48 per cent., and petroleum ether, 13.47 per cent. of the weight of the drug. After complete exhaustion with acetone, the drug residue yielded less than 1 per cent. of extractive to alcohol.

GINGER.

Robert G. Davis, Ph.G., estimated the amount of the oleoresin that could be obtained from the commercial varieties of ginger by the use of the official process for the preparation of that article. The following table states the results obtained, and also the percentages of moisture and ash present in the samples :

Variety.	Form.	Condition.	Oleoresin.	Moisture.	Ash.
Jamaica.	Root.	Bleached.	4'62	12'10	5'25
"	"	"	4'53	10'40	5'25
"	"	Unbleached.	2'82	12'50	3'50
"	"	"	4'41	9'85	3'65
"	Powder.	"	4'30	9'05	5'20
"	"	Bleached.	4'84	9'70	6'55
Race.	"	—	4'09	11'10	5'35
"	"	—	5'40	9'15	5'05
"	Root.	—	4'02	12'20	5'60
African.	"	—	5'75	13'65	4'65
"	Powder.	—	6'27	12'60	4'65
Jamaica.	"	—	3'73	12'15	3'65

SAMBUCUS CANADENSIS.

C. Otto Moosbrugger, Ph.G., made a chemical investigation of the bark of this member of the Caprifoliaceæ, whose flowers are official. The bark is said to be used as a poultice for "foot rot" in cattle. When subjected to analysis it was found to contain :

	Per Cent.
Fat and wax	1'34
Crystallizable resin and chlorophyll	1'78
Substances extracted by absolute alcohol	2'38
Mucilage	2'16
Glucose	2'12
Saccharose, dextrin and other substances dissolved by water	2'86
Pectin and albuminous compounds	6'92
Pararabin compounds	2'36
Lignin	7'86
Moisture	6'83
Ash	5'75
Undetermined organic matter	57'64
	<hr/> 100'00

Tannin, starch, alkaloids and glucosides were not present.

YUCCA FILAMENTOSA.

Max Morris, Ph.G., having heard that a tincture of the root of this plant, which is called "bear grass" in the southern part of the United States, had been used internally in the treatment of rheumatism, decided to investigate the drug chemically. He accordingly collected some of the root near Macon, Ga., and subjected it to a proximate analysis. Wax, fat and caoutchouc were found to constitute the petroleum ether extract. Ether removed a small amount of a resin which gave, with ferric chloride, a brown precipitate, and with lead acetate a brownish-white precipitate. Absolute alcohol

dissolved 5.15 per cent. of substances, which were almost altogether soluble in water. This included 1.70 per cent. of saponin. Water extracted 38.68 per cent. of organic solids, including 4 per cent. of mucilage and albuminoids, 7.65 per cent. of glucose, and 3.5 per cent. of saccharose. A dilute solution of sodium hydrate removed 4.04 per cent. of mucilaginous and albuminous substances. Moisture was present in the air-dry root to the extent of 6.12 per cent., and 5.79 per cent. of ash was left upon incinerating it. No evidence of the presence of alkaloids nor of tannin was obtained.

SIAM GAMBOGE.¹

The tree yielding Siam gamboge (*Garcinia Hanburii*, Hook. f.) is closely related to *G. Morella*, Desrouss., of Ceylon and Southern India. The former is a moderately large tree. The flowers are dioecious, the petals in both male and female flowers are fleshy and yellow. The fruit is the size of a crab-apple, yellowish green when ripe. The tree is found on islands on the east coast of the Gulf of Siam, as well as on the mainland of Cambodia and Cochin China. It is from these localities that practically the whole of the gamboge of commerce is obtained.

Gamboge is a gum resin yielded by the bark of the two species above mentioned. It is a powerful cathartic medicine, but its principal use is as a pigment in water-color painting. It is also used to give color to lacquer varnish for brasswork, etc. The most recent account of Siam gamboge is contained in a report on the trade of Siam for the year 1893, published by the Foreign Office (*Annual Reports*, 1895, No. 1,520). Mr. de Bunsen, Her Majesty's Chargé-d'Affaires at Bangkok, was good enough to communicate to Kew specimens of the leaves of the gamboge trees, collected on the spot by Mr. Beckett, and, although the material is not quite complete, there is little doubt they belong to *Garcinia Hanburii*, Hook. f. The extract from the report is as follows:

"Gamboge is, next to gum benjamin, perhaps, the most interesting of Siamese products. Whilst gum benjamin is peculiar to a small belt of land in the north, gamboge is a resinous product, indigenous only in the islands and the seacoast of the Gulf of Siam lying between the tenth and twelfth degrees of north latitude.²

¹ *Kew Bulletin*, June and July, 1895.

² The heavy rainfall of this coast seems necessary to the existence of the tree.

"I recently had the opportunity of paying a visit to this part of Siam, and it may be of interest to describe the character of the tree and the mode of extracting the resin. The tree is known locally as 'Ton Rong.' It is found only in the islands of Koh Chang, Koh Kong and Koh Rong, and the mainland of the Indo-Chinese peninsula opposite these islands. The trees grow to the height of some fifty feet, and are straight stemmed with no lower branches, owing probably to the dense shade of the forests in which they grow. None of those I saw had a diameter of more than 12 inches. Ten years' growth is said to be required before the tree is ready for tapping. This is carried on by the Cambodian and Siamese islanders in the rainy months, from June to October, when the sap is vigorous, by cutting a spiral line round the trunk from a height of some 10 feet downwards to the ground. Down these grooves the resin wells out of the bark and trickles in a viscous stream into hollow bamboos placed at the base of the tree, and from these it is decanted into smaller bamboos, where it is left for about one month to solidify. To remove the gamboge, the bamboo is placed over a red-hot fire, and the bamboo husk cracking off, there is left an article known as 'pipe' gamboge. The trees can be tapped two or three times during one season, and at the end of the season their trunks present a curious network of intercepting spirals.

Care must be taken to prevent the rain-water mixing with the resin in the grooves, as any mixture of water causes honey-combing and black discoloration, and a consequent depreciation of from 20 to 30 ticals (2*l.*) per picul in value.

The most valuable gamboge is that which is the least honey-combed or discolored, and is all the more difficult to obtain, considering the period of heavy rains during which the resin is extracted.

The bamboos contain on an average rather less than 1 lb. of gamboge, or about 170 bamboos to the picul. The price asked by the pickers themselves is at the rate of 2 ticals (3*s.*) for five bamboos full, and the local price is at the rate of 2 ticals (3*s.*) for three, or 65 ticals (4*l.* 18*s.*) per hundred, or about 8*l.* 7*s.* per picul.

The whole output is sold to local Chinese traders and taken by sailing boat to Bangkok.

SIAM BENZOIN.¹

Benzoin is also known in English commerce as Gum Benjamin. It is a gum resin obtained by incision in the bark of trees in Sumatra and Siam. Benzoin is used as a stimulant and expectorant in chronic bronchitis. It is also one of the principal ingredients in Friar's Balsam, and is largely used for incense. Sumatra benzoin is yielded by *Styrax Benzoin*, Dry., a well-known tree. Plants of this species are under cultivation at Kew, and many have lately been distributed to botanical establishments in the tropics of the New World. Of the tree yielding Siam benzoin we know very little. As long ago as 1865 Sir R. H. Schomburgk, then British Consul at Bangkok, was asked to investigate the subject, but although able to give, at second hand, a very interesting account of the mode of collecting the resin, he was unable to obtain botanical specimens of the tree yielding it. Of late years renewed efforts have been made to solve the problem.

Captain Hicks, of Bangkok, was successful in obtaining a few small plants of "gum benjamin from the Northern Laos States" in 1882. The survivors of these were presented to the Botanic Gardens at Singapore by Mr. Jamie. A fuller account of Captain Hicks' efforts is given by Mr. E. M. Holmes, F.L.S., in the *Pharmaceutical Journal*, XIV, 3, p. 355. The locality from which the plants were obtained was given as "Suang Rabang." This we now know is a misprint for Luang Prabang, a district in the extreme northeast of the Shan States of Siam, bordering on Tran Ninh, in the French territory of Anam. In the hope that the Siam benzoin tree might possibly extend to the Shan States of Burma, an application was addressed by Kew to the India Office in 1889, and as a result a careful inquiry was made by the Government of India, in Tennesserim, Upper Burma, and the adjoining Shan States. In 1890 it was reported that "the efforts made to trace the existence of the plant in these localities have been unsuccessful."

Apparently, the first authentic information respecting the district in which the tree is to be found is contained in a recent report by Mr. Beckett, forwarded to the foreign office by Mr. de Bunsen on the Trade of Siam for 1893 (Foreign Office, Annual Series, 1895, No. 1520). The following extract shows that Siam benzoin is obtained from an extremely circumscribed locality on the east bank of

¹ *Kew Bulletin*, June and July, 1895.

the river Mekong, in territory now occupied by the French. It is feared that the trade in this article will be ultimately diverted to Tonquin, which is nearer to the source of supply than Bangkok.

"Of gum benjamin, 319 piculs, or nearly 20 tons, figure in the export list, valued at 21,005 dollars, or 2,713 $\frac{1}{2}$ l. This valuable resin is also a product of the east bank of the Mekong, and is interesting as being confined to a narrow zone of forest-clad hill country to the east of Luang Prabang, lying between 19th and 21st degrees of north latitude and longitude east 102 to 105. Some three-fifths finds its way to Bangkok by way of Nan, and the remainder by way of Nongkhai and Korat. The French occupation of Luang Prabang does not seem as yet to have caused any perceptible effect on the Bangkok export of gum benjamin beyond enhancing local prices, but with the completion of new roads, already initiated by the French with a view to speedier communication between Luang Prabang and Tonquin, Bangkok exporters, who are chiefly British, have well-founded fears lest the gum benjamin trade be diverted entirely from Bangkok to Hanoi. The whole of the Bangkok export goes to the London market and thence to France and Belgium, to be manipulated into balsam. A small quantity is used locally for frankincense.

"Prices during 1890 were bad, first-class gum benjamin fetching 125 ticals per picul (or about 165 $\frac{1}{2}$ l per ton); 45 ticals per picul (about 40 $\frac{1}{2}$ l per ton). The good quality known to buyers as 'bold, blocky, almondy,' was scarce."¹

As the result of independent inquiry made at the instance of Kew by the India Office, the following further information has been received. This was obtained through the Siamese Minister of the Interior at Bangkok. It affords, therefore, an account of Siam benzoin from the purely native point of view. All the accounts agree in ascribing the region of the benzoin trees to the left bank of the Mekong River, in what is now French territory. This is a tract of upland country east and northeast of the important town of Luang Prabang:

INDIA OFFICE TO ROYAL GARDENS, KEW.

INDIA OFFICE, WHITEHALL, LONDON, S. W.

July 30, 1895.

SIR:—In continuance of previous correspondence, I am directed

¹The remainder of this article is taken from a continuation in the *Kew Bulletin* for August.

by the Secretary of State for India to forward herewith for your information a copy of a letter, and its enclosure, regarding the tree producing Siam benzoin. It is suggested that the memorandum on the Siam benzoin may be found suitable for publication in the *Kew Bulletin*.

I am, etc.,

(Signed)

A. N. WOLLASTON.

The Director,
Royal Gardens, Kew.

Assistant Secretary,
Revenue and Statistics Department.

No. 606.—2 F.—7, dated Rangoon, May 30, 1895.

From the Revenue Secretary to the Chief Commissioner of Burma.

To the Secretary to the Government of India, Revenue and Agricultural Department.

With reference to the correspondence concerning the steps taken with the view of identifying the plant or tree which produces the resin known as "Siam benzoin," I am directed to submit, for the information of the Government of India, a copy of a memorandum regarding the tree that produces this resin, and on the gum benjamin industry in Siam, prepared in Bangkok under the orders of the Siamese Minister of the Interior, and forwarded to the Chief Commissioner by Mr. J. G. Scott, in April, 1894. * * *

Mr. Scott stated that the area in which the gum benjamin trees were found was said to be all on the left bank of the Mekong, and, therefore, in what is now French territory. * * *

Mr. Scott further remarked: "The great Siam benzoin tract is Hna Pan Htang, Ha Htang Hôk, the upland country east and northeast of Luang Prabang. * * *

MEMORANDUM REGARDING THE TREE THAT PRODUCES RESIN, AND ON
THE GUM BENJAMIN INDUSTRY IN SIAM.

The gum benjamin tree is large and tall, and has a heart similar to that of the "teng rang" (a species of *Shorea*) and "phayom" (a kind of mahogany). In its general character, and in the form of its leaves, it resembles the "takieu" tree (a forest tree of hard wood, used for making dug-out boats). The gum benjamin tree is propagated from the original fruit. This, when fallen and lying upon the ground, takes root and sprouts after the fashion of the "phayom" and "gang" trees. As regards the trunk of the gum benjamin tree, there is no one who uses it. Gum benjamin trees are generally

found on elevated ground and do not like the plains country. They grow in isolated patches, like the forests of "teng-rang" and teak. A forest patch of gum benjamin usually contains from fifty to sixty trees and upwards, and the tree is found generally in large numbers along the high hills in the extensive forest region of Slua Phan, Tangslok, and the borders of Müang Theng in the province of Luang Prabang. It is rarely met with in other countries, except those outside the provinces immediately contiguous to Siam. The Siamese Thai, Annamites and Tongsoos, who have settled in the above-mentioned provinces, have worked out and traded in the gum benjamin from an early period for successive generations, and these are scattered amongst the neighboring people, as well as being frequently found in Siam also. The season for working the gum benjamin is from the eighth or ninth months (July and August) to the tenth and twelfth months (September and November), when the season ends. Thenceforward is the period during which the gum benjamin is bought and sold. The gum benjamin is worked after the following methods: So many trees are notched, so as to form a girdle around the stem. An interval of three months is allowed to elapse between the period of notching and that of picking the gum benjamin dammar, which wells out of the trunk and collects in the notches. By means of a sharpened stick or the point of a knife this is picked out, bark and all, and gathered at once in baskets. It is then sorted and divided into different classes, according to choice. Picking cannot commence before the interval of three months has elapsed, as the dammar that has trickled out into the notches would not have had time to harden. It would still be soft and sticky, and if picked at the time would become dirty, owing to the bark coming off with it; nor would it be of such value either, as, being sticky, it would cling to other things and the full benefit would not be derived, such as would be the case if it were properly dry. For this reason the gum benjamin must be left for three months after the notching, in order that all the gum possible may well out, and it may become dry and hard. Among the people above-mentioned the picking and sale of gum benjamin is generally considered as one way of obtaining a livelihood, for the gum has a value and is reckoned as a marketable commodity. And even if the people have no other occupation than selling gum benjamin, that by itself is sufficient as a means of livelihood. The period during which the

gum benjamin is sold is not necessarily confined to the eighth or ninth months. The reason for selecting that season is because the people of those parts have many other things to do; for instance, they have to plow the fields and reap their rice harvest. In the eighth and ninth months their work on the paddy fields is finished, and they can therefore turn their attention to gum benjamin. For this reason there is a special season. Their paddy fields are their first care, and then the gum benjamin trade. Those who have no business with plowing paddy fields and planting rice can, if they wish, work continuously at gum benjamin, at all seasons and during every month of the year. The gum benjamin trade requires no very great outlay of capital. All the implements required are one large axe, a rice basket and an open woven basket. If a person wishes to work alone, without servants to assist him, he can do so; for in the first stages there is nothing much that requires to be lifted or carried. The only labor necessary would be when the gum benjamin is being picked and placed in baskets, and has to be carried to the temporary or permanent home of the picker. The profits gained on any one particular occasion or another can hardly be gauged accurately. Those who work out much sell at a large profit; those who work out little sell at smaller profit. One catty ($133\frac{1}{3}$ pounds) and upwards would be considered a large output. Picked gum benjamin is sorted into three classes. The best class, and that which fetches a high price, is called "slua," and is that which is sold in large lumps, and is not dirtied by the presence of bark. The second class is that left over from the first class, and is in somewhat smaller lumps than the latter, and has some, but not much, bark attached to it. This is inferior in quality to Class I, and is half the value. That is to say, if Class I is sold at 75 ticals, Class II would sell at $37\frac{1}{2}$ ticals. The third class is that left over from Class II. This class has bark attached to it, is soiled with dust and dirt, and is in small, fine pieces. It is called "mun," and is half the value of Class II. The price of gum benjamin, as sold in the jungle districts where the gum is worked, is as follows: Class I, one Chinese catty ($66\frac{2}{3}$ pounds), 100 or about 75 ticals. Class II, half the price of Class I. Class III, half the price of Class II. The price in Bangkok is: Class I, one Chinese catty, 260 ticals, as it has always been.

The gum benjamin trees that grow in the jungle districts referred to are not the subject of disputed ownership by one person more

than another. Any one who wishes to work gum benjamin has merely to go into the jungle, search for and notch as many trees as he pleases, like people, for example, who go into the jungle to cut posts for their houses. Nor is there any tax or other emolument accruing to the country from either the trunk or the gum of the gum benjamin tree; nor is the gum benjamin trade one in the prosecution of which much thieving or fighting arises, whether it is because there are many people together at a time, or because, being in the jungle where there are fierce tigers, one man cannot steal along alone by himself, but is obliged to travel with parties, and so robbery and theft are rendered impossible, is uncertain. This gum is sweet-scented, and is much used in mixing either with medicines or scents of various kinds. For whichever of these purposes it is sold, it always fetches a high price, like other valuable commodities, and for that reason gum benjamin is an article of commerce which merchants have bought and sold from time immemorial to the present day.

THE ACTION OF HEAT UPON THE ALKALOIDS OF IPECACUANHA.¹

BY DR. B. H. PAUL AND A. J. COWNLEY.

Experiments carried out by Braithwaite and Umney, as well as some previous observations by Cripps, showed that by heating the acetic acid extract of ipecacuanha some considerable loss of alkaloid resulted. Hence it was inferred that the official B. P. process for preparing ipecacuanha wine is open to objection, since the extract obtained in that way requires to be heated for several hours on a water bath before it can be reduced to powder as directed.

At the time these experiments were made the existence of two distinct alkaloids in ipecacuanha root had not been ascertained, and the question arose whether the observed loss of alkaloid applied to both emetine and cephaeline, or only to one of these alkaloids.

From our own observations we were of opinion that the salts of these alkaloids do not suffer alteration when heated to a temperature of 100° C., but it seemed desirable to obtain some further information on this point, and also to ascertain whether the loss of alkaloid observed in making ipecacuanha wine is due to the altera-

¹*Pharmaceutical Journal* (4), 1, 2.

tion of emetine or of cephaeline. With that object the following experiments were made with the pure alkaloids :

A solution of .0968 gramme emetine in 53 minims strong hydrochloric acid, diluted with two fluid ounces of water, was evaporated, and the dry residue heated for sixteen hours upon a water bath. At the end of that time the residue was but very slightly colored, and was found to contain .09512 gramme of alkaloid, a difference from the quantity taken not greater than may be ascribed to experimental error.

In a similar experiment with .09504 gramme cephaeline a like result was obtained, the quantity of alkaloid found in the residue after evaporation being .09328 gramme.

The effect of long-continued boiling (sixteen hours) of solutions of emetine and cephaeline containing excess of acetic acid was then tried. In both instances there was but little alteration in the color of the solutions, and the quantity of alkaloid afterwards extracted was almost the same as that originally taken for the treatment.

Under both of these conditions there appears to be very little alteration of either emetine or cephaeline. The result is, however, very different when solutions of either of these alkaloids in acetic acid are evaporated, and the dry residue is heated for some length of time. In that case the solution becomes colored as the evaporation advances, and the dry residue has a dark brown color, which is more marked with cephaeline. The residues left on evaporating acetic solutions of the alkaloids have an alkaline reaction, from which it would appear that the acetates are decomposed by heating, and that the alteration of the alkaloids is due to the action of heat upon them in the free state. An experiment made to ascertain this point, by heating cephaeline moistened with water in an open basin, and keeping the dry residue hot on a water bath for sixteen hours, showed that, under these conditions, there was a loss of alkaloid amounting to 17.6 per cent., with considerable darkening. On dissolving the residue in hydrochloric acid, adding ammonia, and shaking out with ether, only a few crystals were obtained, and the ammoniacal liquor presented a marked fluorescent appearance.

To ascertain more exactly the extent to which each of the two different alkaloids of ipecacuanha is altered when the dry residue of an acetic solution is exposed to heat, the following experiments were made :

A solution containing 0.09698 gramme emetine in 85 minims of acetic acid, diluted with 2 fluidounces of water, was evaporated to dryness in an open basin on a water bath, and the dry residue kept at the same temperature for 16 hours. The quantity of alkaloid was then determined by dissolving the residue with hydrochloric acid, adding ammonia and shaking out with chloroform, then titrating the residue from the chloroform solution; it amounted to 0.07087 gramme, showing a loss of .02611, or nearly 27 per cent. of the alkaloid operated upon.

In a similar experiment with .09504 gramme cephaeline, the quantity of alkaloid found in the residue was .07392, showing a loss of .02112, or upwards of 22 per cent.

In both cases there was evident alteration of the alkaloids. The residues left by the acetic solutions after evaporation were very dark colored. That obtained from cephaeline no longer gave the characteristic crystallization when shaken with ether and ammonia, and the alkaline liquor was highly colored as well as fluorescent.

In order to further test the influence of heat in altering the alkaloid contained in ipecacuanha, the emetic action of the residue obtained by heating cephaeline with excess of acetic acid was tried, and it was found that a dose of .01 gramme produced no emesis in 30 minutes.

The alteration above mentioned does not appear to be merely the result of heating, for when cephaeline was heated to its melting point for 13 hours in a partially closed vessel, there was practically no alteration of alkaloid beyond a very slight loss of weight, which might be ascribed to the presence of some adherent ether or moisture. This result seemed to point to the fact that presence of air is necessary for effecting the alteration observed when the alkaloid is heated in an open basin.

CHEMICAL LABORATORY,

13 FENCHURCH AVENUE, E. C.

NOTES ON CURING CACAO.

BY W. CRADWICK, Superintendent of Hope Gardens.

The following instructions to those who grow cacao on a small scale have been issued by the Department of Public Gardens and Plantations, Jamaica, and appeared in the *Bulletin* of that department for July, 1895:

The first important point to be observed when about to cure cacao is that it must be quite ripe, but not over-ripe. The pods must have attained their full color, whatever it may be, but if the beans shake about easily then the pod is over-ripe. The reason is, that if the beans are not ripe, the mucilaginous matter covering the beans is not properly developed into the stage when it will readily ferment. If left to get over-ripe, the mucilage commences to liquify.

The best vessel in which a small cultivator can ferment cacao is an ordinary flour barrel. To prepare this for the reception of cacao beans, first bore about a dozen holes, each a half an inch in diameter, in the bottom of the barrel; then place about ten inches of banana trash in the bottom of the barrel. Line the sides also thickly with trash, and have a sufficient quantity on hand to cover the beans when placed in the barrel. When the barrel is ready, break the whole of the pods and place the beans in the barrel, covering with the banana trash. The beans must be left to ferment for two days, then remove one-third of the beans, lay them in a heap on the floor, and mix them thoroughly. Remove the balance of the beans, and mix them also, but do not put the two heaps together. After placing fresh trash in the barrel, put the beans which were at the top back into the bottom of the barrel, and those which were at the bottom, place at the top. Cover with the trash in the same way as before, and leave for two more days, when the beans should be treated in exactly the same way as before. They should then be left for two more days, when they should be taken out and washed thoroughly.

On the day the beans are finally removed from the barrel the work should be commenced very early in the morning, so as to get all the sun possible on the first day, for the beans mildew very quickly. They should be washed immediately after they are taken out of the barrel, as this helps to keep them plump.

The proper amount of cacao to ferment in one barrel is the quantity of beans obtained from 1,000 ordinary sized pods. If many more than this number are put into one barrel the fermentation is too great, and the beans turn black.

If a less quantity, say, below 700 pods, is to be fermented, the green trash and more of it must be used, and a weight not exceeding 28 pounds placed on top, which helps the fermentation. During the time of drying the cacao it is not desirable to expose it after the

first two days to the extreme heat of the midday sun; it is better to take it in about nine o'clock, and then put it out again between three and four o'clock. Those who use the evaporators are warned against an excessively high temperature.

Great care must be taken when removing the pods from the trees that they be cut off with a good, sharp knife, not pulled off. If pulled off, the little knob at the base of the stem of the pod is injured, and the tree will not bear from the same spot the following year. If the pods are cut off carefully, the tree goes on bearing from the same spot year after year.

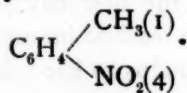
NOTE ON SINALBIN MUSTARD OIL.

BY L. E. SAYRE.

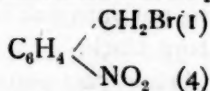
Since writing the article on "A Review of the Constituents of White and Black Mustard Seed," published in the July number of this *Journal*, Prof. J. U. Lloyd has called my attention to an article by H. Salkowski, in *Berichte d. deutsch. chem. Ges.*, 1889, vol. 22, p. 2137, in which it is stated that the acid which Will and Laubenthaler obtained from sinalbin, and pronounced to be the *ortho* oxyphenylacetic acid, has none of the properties of either *ortho* or *meta* oxyphenylacetic acid, but seems to be identical with the para-acid. H. Salkowski manufactured the sinalbin mustard oil by treating para-oxybenzylamin with CS_2 , and the resulting product with HgCl_2 . The sinalbin mustard oil thus obtained has a burning taste, and produces blisters on the skin; is soluble in dilute alkali, but insoluble in water. It only slightly volatilizes with steam.

This being the case, I desire to change the possible reactions leading to a synthetized preparation, as published in the article referred to, as follows:

(1) Beginning with the para-nitro-toluidene



add bromine and heat to 130° to 160° in a sealed tube until the reaction is completed. The result will be para-nitro-benzyl bromide



Treat this with a reducing agent ($\text{Zn} + \text{HCl}$). The result will be *ortho*-amido-benzyl bromide, etc. See *Amer. Jour. Pharm.*, July, p. 345.

THE ALKALOIDAL VALUE OF IPECAC STEMS.

BY ALFRED R. L. DOHME.

Presented to the American Pharmaceutical Association, Denver Meeting, 1895.

In previous experiments it has been shown that the cork cells and those of the cortical parenchyma adjacent to them are the seat of the alkaloids of ipecac root. Furthermore it has been shown that the thinner root contains more alkaloid than the thicker or fancy root.

Since then it has been observed by the writer that what he termed "wiry" root is made up of two parts of the plant, viz.: the stem proper and the part of the plant that merges the root into the stem. While the stems are usually quite straight, with a smooth surface, the part that merges it into the root is almost invariably twisted and slightly annulated. This then divided the ipecac root of commerce into three varieties, *root*, *merging portion* and *stems*, which shall here be designated respectively as fancy root, wiry root, and stems.

Two lots, "A" and "B," of commercial ipecac root were spread out separately, and each divided up into three portions representing "fancy root," "stems," and the "merging portions." All six portions were assayed by Keller's method, using titration with volumetric acid solution, and with the following results:

Ipecac Root, Sample "A."

Fancy root	2.00 per cent. alkaloids.
Wiry root	2.13 " "
Stems	1.77 " "

Ipecac Root, Sample "B."

Fancy root	2.33 per cent. alkaloids.
Wiry root	2.43 " "
Stems	2.15 " "

From these results but one conclusion can be drawn, and that is that the wiry root, as was shown last year, is richer in alkaloid than the fancy root, and that the stems contain less alkaloid than either the fancy or wiry root, but still contain considerable alkaloid.

BALTIMORE, June 25, 1895.

ASSAY OF WILD CHERRY BARK.

BY A. B. STEVENS, PH.C., AND J. N. JUDY, PH.C.

Presented to the American Pharmaceutical Association, Denver Meeting, 1895.

QUERY NO. 1.—“Is the thin, green wild cherry bark really more valuable therapeutically than the older and thicker bark?” Make comparative assays.

The therapeutic value of the bark depends upon the amount of the active principles within the bark. This principle is a glucoside, identical with or closely allied to amygdalin. Therefore, the query can be answered only by a comparison of the results obtained by the assays requested.

The thick bark occurs in the market in slightly curved or arched pieces of various sizes, the length being about 25 to 80 mm., and the breadth 13.5 to 50 mm. The thickness of the pieces which consist entirely (or nearly so) of the inner bark is about 3.15 to 4.16 mm. In cases where the outer portion of the bark is attached it is nearly or quite 6 mm. thick.

The thin bark has the principal characteristics of the thick bark, such as odor, fracture and color, which may vary somewhat, also differing in thickness, being about 2 to 2.8 mm. thick. It is also found in the market in somewhat smaller fragments than the thick bark.

Both the thick and thin barks vary in color and other external characteristics according to the size of the pieces, and the presence or absence of the periderm, etc. When the periderm is attached, the pieces are of rougher character, and in such parts of the bark the color is redder, and somewhat spotted at intervals with irregular grayish silver-white or brownish patches. Some of the smaller pieces, particularly the thin bark, presents a uniform reddish-yellow appearance, and is nearly smooth externally. Internally the bark has a deep yellowish or reddish-brown color, the color of the thick bark being the more intense. On the inner surface of the bark occasional portions of wood are found. The longitudinal fracture is close and presents a rough surface of a yellowish-gray color interspersed with reddish spots and stripes. The transverse fracture is close, somewhat rough and fibrous, and of a redder hue than the longitudinal. The texture of the bark is somewhat spongy, particularly the inner layers.

Carefully selected samples of each variety were obtained and the wood and outside rough portions removed, after which the bark was

ground into fine powder and each sample placed in a glass-stoppered bottle.

The method of estimation was based upon the conversion of the glucoside into hydrocyanic acid and a volatile oil; second, upon the distillation of the hydrocyanic acid to separate it from the bark; and third, upon the estimation of the hydrocyanic acid. Two methods were used. The details of the operations are as follows:

First method.—Ten grammes of the drug were placed in a small flask, about 100 c.c. of water were added, corked tightly, macerated for twelve hours, and connected with a large condenser. A moderate heat was then applied and the distillate conducted into a solution of potassium hydroxide, the distillation being continued almost to dryness. About 150 c.c. more of distilled water were added through a glass-stoppered thistle tube, and distillation continued as before. This operation was repeated not less than four times to secure the absolute removal of all the hydrocyanic acid from the drug, after which the condenser was thoroughly rinsed to remove any adhering hydrocyanic acid. The amount of acid was then estimated volumetrically, by titrating the slightly alkaline solution of potassium cyanide with decinormal silver nitrate solution.

The second method of estimation was as follows: The drug was macerated and distillation continued as in the first method, but this time the distillate was conducted into a solution of silver nitrate. An insoluble silver cyanide was formed. The precipitate was allowed to settle, the supernatant liquid decanted through small counterpoised filters, the precipitate transferred to the filter, washed, dried and weighed.

The glucoside was estimated without decomposition, as follows:

Five grammes of the drug were placed in a Soxhlet's apparatus, extracted with absolute alcohol for six hours, and the alcoholic extract evaporated to a syrupy consistence. An excess of ether was added, precipitating all the glucoside, together with some coloring matter and resin. The precipitate was washed with ether, on the filter, and treated for a short time with 100 c.c. of boiling distilled water. The solution was allowed to cool. The glucoside in solution was filtered, the filter washed with a little hot water, and the washings and filtrate mixed. The solution was evaporated to dryness in a weighed porcelain dish, and again weighed; the increase in weight represented the glucoside.

In order to test the accuracy of the above method, and to ascertain the number of distillations necessary to obtain all of the acid, the distillates were collected separately, and the acid in each estimated with the following results:

First distillate	17.15 per cent. hydrocyanic acid.
Second "	11.2 " "
Third "	5.25 " "
Fourth "	1.05 " "
Fifth "	0.00 " "

To verify the above, a number of experiments were made by adding a known quantity of hydrocyanic acid to previously exhausted bark and to other drugs like cinnamon. These were subjected to distillation under exactly the same conditions as in the preceding case, with the following results:

First distillate	56.0 per cent. of total acid added.
Second "	32.0 " "
Third "	8.0 " "
Fourth "	2.8 " "
Fifth "	0.0 " "

In no case could all of the hydrocyanic acid which was mixed with the powder be recovered. The loss was about 1 per cent.

ASSAY OF BARK.

Average results of several estimations upon each sample of the bark:

Thick Bark.

First method, No. 1,	0.035 per cent. of hydrocyanic acid.
" " 2,	0.35 " " "
" " 3,	0.34 " " "
" " 4,	0.323 " " "
" " 5,	0.348 " " "
Second method, " 1,	0.319 " " "
" " 2,	0.323 " " "

Thin Bark.

First method, No. 1,	0.24 per cent. of hydrocyanic acid.
" " 2,	0.264 " " "
" " 3,	0.27 " " "
" " 4,	0.268 " " "
Second method, " 1,	0.229 " " "
" " 2,	0.238 " " "

Yield of amygdalin (or allied substance):

Thick bark, average 4.12 per cent.

Thin bark, average 3.16 per cent.

Of the two methods given for the estimation of the acid, the first is the more accurate and satisfactory. Much care is required in manipulating the precipitate of silver cyanide in the second.

The yield of hydrocyanic acid as above stated is more than twice that previously reported. J. S. Perot (AM. JOUR. PH., Vol. 24, 1852, page 111) found from 0.0478 to 0.1436 per cent. We believe that the result is due to the improved method of estimation, as numerous experiments proved that only about half of the acid was obtained during the first distillation.

The above results appear to furnish to the query a negative answer.

ANN ARBOR, MICH., June 15, 1895.

THE FUTURE OF THE TURPENTINE INDUSTRY.

In a communication to *Garden and Forest* of July 10, 1895, L. J. Vance gives his opinions of the "Future of the Long-leaf Pine Belt," and as this is intimately connected with the turpentine industry, we reproduce it as follows:

A few weeks ago, when I was in the pine district of the South, every evening the sky was illumined by a dull red glare, and in the daytime the horizon was obscured by a thin veil of smoky haze. The cause of this was the turpentine industry, which has now reached its busiest season.

Few people who have not been in what is called "the long-leaf pine belt" of the South can have any real idea of the extent of the damage done to the country by the turpentine workers and by the lumbermen, both of whom conduct their business on what has been bluntly called "the robbing system." They have left immense areas of land robbed not only of its natural resources, but in a worse condition for clearing and culture than before their invasion. Such is, without doubt, the case of many square miles in the two Carolinas, in Georgia, in Alabama and in Louisiana.

The result is that the most bare and barren places in all the South are those that have been visited by the army of turpentine gatherers. Every Northern visitor familiar with well-ordered and cultivated farm lands and houses is struck by the great tracts of Southern country on which there is no vegetation of any value. These wastes are deserted and uninhabited, except here and there by the negro's lonely cabin.

The loss from fires is enormous. The turpentine workers are so careless and indifferent as to allow fires to run through the tracts in which they have worked. The resin on the scarified surface of the trees burns like kerosene; a spark, a blaze, and all at once a disastrous conflagration is sweeping through the pine forests with great fury, destroying millions of feet of marketable timber, and leaving hundreds of acres a scene of awful ruin.

This is no highly-colored story, but a plain statement of what has been going on in the pine belt for years. Now and then protests have been raised against the reckless manner in which these forests are being destroyed, and yet very little has been done either by private or by public action to protect one of the greatest resources of the Southern States.

This is the more remarkable when we consider the enormous wealth represented by the long-leaf pine belt. There is a strip of pine forest about one hundred miles wide that begins in North Carolina and follows the Atlantic and Gulf Coast plain to Texas, crossing six States, and covering an area of about 130,000 square miles. At a rough estimate, there may be 50,000,000,000 feet standing in this area, and if we take the values of timber and turpentine, the annual product of the forests of the South will approach in value the product of her cotton fields.

The pineries of the South now yield naval stores worth nearly \$10,000,000 a year. The total production amounts to 340,000 casks of spirits of turpentine, and 1,490,000 barrels of resin. In order to produce this enormous yield, some 2,500,000 acres of pine forest are being worked, and nearly 1,000,000 acres of virgin forest are invaded annually. Now, no one will claim that these pineries are inexhaustible, for there has actually been a decline in the production of naval stores within the past eight or ten years. The reckless cutting and tapping of trees have made great inroads into the magnificent stretch of pine. Railroads have opened up many new tracts of timber, the old water-mills have been replaced by steam saw-mills, and, when the supply in the neighborhood was exhausted, tram-roads have been built or the steam mills taken to new territory. Thus, the work of consumption and denudation has been carried on to such an extent that fears are just now beginning to be entertained that these valuable forests will be sacrificed to the greed for immediate and temporary gain.

The truth is, the long-leaf pine belt is the backbone of the South Atlantic States. For 150 years it has been the chief resource of the people who dwell in the belt. The production of pitch and tar was begun in North Carolina during colonial days, and, as the State took the lead in the industry, its people were called "tar heels." There has been a heavy decline in the production of naval stores in North Carolina. This decline, amounting to fully 40 per cent., is due simply to the exhaustion of the pine forests. Of course, much has been written on the destructive agency of the turpentine industry, and many suggestions have been made regarding changes and improvements which are necessary. It is agreed that the turpentine industry, as carried on in the United States, results in great loss and damage, directly and indirectly. Compared with the way in which the French gather turpentine, our methods seem crude, wasteful and almost irrational.

The American turpentine workers still continue to follow the old-time methods of tapping the trees for their sap. They have made few changes, and have adopted few improvements. They cut a deep, broad "box" at the base of the tree, and then the surface above the box is laid bare. The trees are worked for four or five seasons, when they become practically exhausted of their sap. The forest is then abandoned to the elements, to the bark-beetles and pine-borers, and, finally, the splendid trees are blown, burned or cut down. The French turpentine worker cuts no deep box into the tree, but uses a pail,

into which the resin or crude turpentine is conducted by a gutter. He makes only a small chip about three or four inches wide, and this is enlarged from time to time. After five seasons' working, the trees are given a rest of several years, and so, by alternating periods of tapping and of rest, a tree can be profitably worked for fully fifty years. The French also take measures to regenerate their pine forests and to keep the trees strong and uniform.

If our turpentine workers understood the first principles of forestry they would modify their destructive methods. With more knowledge based on experience, the day will come when the Southern people will see that good husbandry consists in management, not destruction, of their forest resources; that some precautions and some protection are necessary against fire, as well as individual greed; that the present policy of the turpentine workers is lamentably wasteful and short-sighted; in other words, that it is more profitable to work the pine forests for fifty years, instead of five years; and, finally, that the lumber and turpentine industries, while changing the face of Nature, and even the climate of the country, are slowly, but surely, making loss and trouble for this and succeeding generations.

According to the *Agricultural Gazette*, of New South Wales, the true opium poppy can be easily and successfully grown in that country, where, in favorable seasons, the plant will flower in about fifteen weeks from the time of planting. As soon as the flower falls, the capsule is slightly cut across one side in the afternoon to let out the milky juice. About four wounds are made. The next morning the milky juice will have hardened into a thin gum, which is scraped off with a blunt knife, and transferred from the knife into a clean tin vessel. The unwounded side of the capsule is operated on the following afternoon. The collected gum or opium is made into thin cakes and carefully dried in the shade. The work of opium collecting is one which can be done by careful women and children. When nothing but the seeds or heads are required the poppy is planted broadcast and hoed out or thinned to a distance of nine inches apart. About 40,000 heads can be gathered to the acre, and when dried they are worth about \$5 per 1,000. The seed bring 25 cents an ounce in Sydney.—*Garden and Forest.*

In a lecture on *The Adulteration of Drugs*, Dr. Willis G. Tucker, Director of the New York State Board of Health Laboratory, closed his remarks with the following sensible statements:

"I have little sympathy with the sensational revelations that are made in a spasmodic way from time to time by the newspapers, and occasionally by State officials. They are so often exaggerated and unjust that they accomplish little good and sometimes do much harm. They cast reproach upon a reputable body of men, and the motives which instigate these exposures are not always above suspicion. The cause of sound pharmacy will not be advanced by sensational disclosures in the public prints, and only as, by gradually effected changes, we weed out the incompetent or restrict their privileges, and put a premium upon competency and ability, and secure for those who enter upon this calling a better training for the work and magnify its importance and its responsibilities, can we hope to raise the standard of American pharmacy to the high plane which it should deservedly, and in my belief will eventually, occupy."

EDITORIAL.

INSTRUCTION BEFORE DEGREES.

It has not been long since we heard a well-known teacher in a college of pharmacy say in reference to education :

"It is not so much a question of degrees as it is one of instruction ; offer the right kind of instruction and let the degrees be a secondary consideration."

It strikes us that this is the key-note of the whole subject.

The college graduate will be judged not only by his knowledge at the prescription counter, but also by his behavior and tact towards customers. When he is placed on trial by the proprietor, does he show these qualifications, or does he display his titles? Does it matter then whether he has had 600 or 6,000 hours of college instruction? He may be able to write all the reactions involved in the preparation of *liquor ammonii acetatis*, but if he cannot decipher the obscure chirography of the physician, if he cannot name the price of this simple prescription without hesitation, and if he cannot bottle, cork, wrap and deliver in a way to inspire the confidence of both customer and proprietor, he is lost so far as that situation is concerned. Where, and where only, can he best learn these small but vital matters? Is he to be kept from them until he is twenty-one years of age, and then, loaded with a heavy title, go into a store and have the errand-boy give him points? Or is he to "cram" for 600 hours, pass his examinations, and then go into a store to learn the business?

We have had too many windy effusions about the number of hours of instruction. Knowledge cannot be measured by the yard-stick, nor by hours of instruction. It is gained by experience and judicious study, not by memorizing the order of the words on the page of a book. Everyone who knows anything of education is aware that one hour of study a day for six days is better than six hours of study in one day, or that six hours of study per week for six weeks are better than thirty-six hours of study in one week. The same principle applies to laboratory work. Is not the student who devotes four years to studying pharmacy, and who distributes his time between the college and the shop, infinitely better educated than the one who has all his college study "crammed" into one year, then graduates with flying colors, and afterwards starts in to really learn the rudiments of the drug business, and get his shop practice?

The respectable medical colleges have devoted large sums of money to equip and conduct hospitals in order that their students may combine theory and practice. Would any sane medical student, or graduate either, undertake an important amputation after having simply studied a work on surgery? Does he not first dissect the cadaver, then see the operation performed by others on the living subject, and then assist at one or more similar operations before he undertakes it himself? Is the case of the pharmaceutical student very different from this? We have had enough of this talk in the American Pharmaceutical Association about pharmaceutical education. It is about time to rule the whole subject out of order, or in some other way deliver the members from the "long-winded" papers and "spoutings" of a few charlatans who never had the advancement of pharmaceutical education at heart, who are not in science for the sake of science, and to whom anything but their own unmerited advancement is a foreign thought.

THE MEDICINAL VALUE OF THE RARER ELEMENTS.

The paper on page 511 of this issue, by Mr. H. C. Demming, may strike some as being in advance of our present knowledge, but a little more careful study will show that it is full of practical suggestions. The compounds of the rare metals may possess valuable curative powers, and they should receive careful attention, not because they are rare, but because they have specific properties which have never been investigated.

At the present time uranium nitrate is on trial in the treatment of diabetes mellitus, and an article in the *British Medical Journal* for August 24th gives the experience of Dr. Samuel West, of St. Bartholomew's Hospital, London, with this agent. Chittenden, in 1888, showed that full doses of uranium salts produced in dogs acute parenchymatous nephritis, with much albumin in the urine. Further investigation by Dr. West showed that even in small quantities uranium and its salts had an inhibitory influence on amylolytic and proteolytic action, so that a few drops of a 1 per cent. solution of the nitrate prevented the action of ptyalin, and a rather larger quantity that of pepsin and trypsin.

The effect on the human subject has been to greatly retard if not inhibit the secretion of glucose. In the hospital experiments two salts were employed—the nitrate and the double chloride of uranium and quinine. It was found that the best method of administering the nitrate was by free dilution with water, and after food, commencing with a small dose of one or two grains twice daily after the chief meals, and increasing the dose slowly at intervals of a few days, until its effect was produced. As much as fifteen and twenty grains were given three times a day without causing irritation of the stomach and bowels.

We may expect ere long to have physicians call for compounds of all the rarer elements.

THE NATIONAL FORMULARY.

The Kentucky Pharmaceutical Association has issued a circular calling attention to its issue of an epitome of the National Formulary, in accordance with the action of the Association at its meeting in 1894, when the President, Mr. R. J. Snyder, made the suggestion that an epitome be prepared and supplied to members at actual cost price, so as to enable them to deliver the book to physicians with their compliments, and in that way induce the latter to prescribe legitimate remedies whose composition is known.

A similar suggestion was made by Mr. John F. Patton in the Pennsylvania Pharmaceutical Association, and published in this JOURNAL, 1894, page 330, but it did not receive any further attention at the hands of that body, probably because it was recommended to give the National Formulary as it is now published to physicians. A suggestion similar to that of the Kentucky Association was made in the meeting of the American Pharmaceutical Association last year, at Asheville; and this year, at Denver, Council was given power to act.

The epitome, as issued by the Kentucky Association, is a small, leather-bound, vest-pocket edition, containing fifty-three pages, and is so arranged that the name (according to scientific nomenclature), ingredients and quantity in each dose, and general medical properties of each preparation, can be seen at a glance. A therapeutic index has also been added, whereby a number of formulas may be found for the same indications.

The National Association should have led in this matter, but it is to be hoped that the Kentucky Association, with the good of all at heart, will do as the originators of the Formulary did—offer it to the American Association next year, and thereby enable every pharmacist in the United States to secure copies at a very low price; for by printing one large edition, a much better rate can be secured than by each State Association undertaking to print its own.

REVIEWS AND BIBLIOGRAPHICAL NOTICES.

CHEMISTRY OF URINE.—A practical guide to the analytical examination of diabetic, albuminous and gouty urine. By Alfred H. Allen, F.I.C., F.C.S. Philadelphia: P. Blakiston, Son & Co. 1895.

There have been many books on the chemistry of urine written by physicians, but few by the members of other professions. Now, however, we have one by a chemist of more than ordinary ability, who writes not of what others have said so much as of his own experience in his laboratory with a great variety of samples.

Mr. Allen is well known by his valuable volumes on Commercial Organic Analysis, and the present work of 212 pages is in binding uniform with them.

The scope of the work can best be comprehended by the following quotation from the preface: "While attempting to bring the majority of the tests and processes within the scope of every-day clinical diagnosis, or of the reports required for life assurance, I have also described other methods which cannot be applied except by those accustomed to analytical work, and who are possessed of the appliances of a well-appointed laboratory.

"While desiring to give special prominence to the methods of examining diabetic, albuminous and gouty urine, it appeared undesirable to omit all reference to subjects of collateral interest, such as the proportions of urea and total nitrogen in urine, the recent researches on creatinine and on xanthine derivatives, and the behavior of urinary coloring matters."

The author has adhered to a rule in regard to spelling, which should be universally adopted, as follows: "The term 'albumen' should be limited to its original signification, namely, the white of egg, the word 'albumin' being applied to the most characteristic constituent thereof, and extended to other analagous substances contained in blood-serum, etc."

The following are the leading sections of the work: General composition of urine, preliminary examination of urine, diabetic urine, albuminous urine, the nitrogenized constituents of urine, coloring matters of urine, and appendix.

Acetonuria is included in the section on diabetic urine, and the author, after quoting a number of tests, recommends the one in which iodoform is formed by the addition of potassium hydrate and solution of iodine.

A number of processes are given for the detection and estimation of glucose, and we note with satisfaction that it is recommended to remove phosphates, uric acid, xanthine, creatinine and albumin, before applying the tests for glucose or attempting to estimate it; this is a precaution which is not sufficiently emphasized in the works which have heretofore been written on the subject. The phenyl-hydrazine test has received full consideration, the following statement being made in regard to it: "As all the methods of detecting sugar in

urine, which are based on the reducing action of glucose, are more or less vitiated by the presence of other reducing bodies, a special reagent for glucose has an exceptional value. This reagent exists in phenyl-hydrazine."

In reference to albumin, the author states: "Normal urine is almost, if not entirely, free from any trace of albumin or other of the allied substances classed together under the generic name of 'proteids.' But under particular conditions of fatigue or disease, albumin may appear in the urine."

The total nitrogen is estimated by a process worked out in the author's own laboratory, and the amount of urea is determined by a modification of Squibb's process.

Creatinine is very fully considered, and the fact is pointed out that its behaviour with picric acid gravely affects the value of that reagent as a test for small quantities of sugar in urine.

It also reduces Fehling's solution on boiling, the blue liquid changing to yellow, but no cuprous oxide separates. In view of these statements, it is all the more remarkable that most works on the analysis of urine say nothing about preparing a urine by removing this and other bodies, before applying the ordinary tests for glucose.

The illustrations of the book are well executed and useful. The appendix contains a number of valuable tables. On the whole we are prepared to say that this is the best book on this subject that has ever been written, and all those physicians and pharmacists who have occasion to analyze urine should give it the closest study.

THEORETICAL CHEMISTRY. From the standpoint of Avogadro's rule and thermodynamics. By Prof. Walter Nernst, Ph.D., of the University of Göttingen. Translated by Prof. Charles Skeelee Palmer, Ph.D., of the University of Colorado, with twenty-six woodcuts and two appendices. Macmillan & Co., London and New York, 1895. 697 pages. Price, \$5.00.

When the German edition appeared, about two years ago, it was at once recognized as filling a demand created by the recent developments of physical chemistry. It might be argued that the two excellent treatises of Ostwald cover the whole field, which they do, but the comprehensive "Manual of Chemistry" is too exhaustive for the average student and can only be grasped completely by the specialist in physical chemistry, and the "Outlines" is too brief for those who desire to extend their knowledge beyond the mere elements of the subject. Prof. Nernst, with his timely volume, has happily supplied the existing deficiency.

A brief enumeration of the subjects treated will give the reader a fair idea of its contents. The introduction treats of the fundamental principles of modern investigations. Book I considers the universal properties of matter, such as the gaseous, liquid and solid states of aggregation; physical mixtures and dilute solutions. Book II treats of the atomic theory, determination of molecular weights, kinetic theory of the molecule, constitution and absolute size of the molecules, colloidal solutions, and physical properties of salt solutions. In Book III, the transformation of matter is discussed. This includes the law of mass reaction, chemical statics of homogeneous and heterogeneous systems, chemical kinetics and chemical equilibrium in salt solutions. Book IV, the transformation of energy or thermo-chemistry, electro-chemistry and photo-

chemistry. Appendix I contains the more important developments of theoretical and physical chemistry for the year 1893. Appendix II consists of a synchronistic table of chemical periodicals.

A translation of this valuable volume into the English language was a most laudable undertaking. It is unfortunate, however, that such a work must be adversely criticised. The translator aimed "to combine fidelity to the original, with clearness in good English." If he succeeded in the former he certainly fell far short in the latter. The frequent use of the indefinite pronoun "one" makes the reading monotonous at times. In a single paragraph it occurs four times, and not less than a half a dozen times on a number of pages. The translation in some cases is too literal. While such translations cannot be considered as violating the principles of rhetoric, yet they are far from choice English.

On page 20, foot-note, it is recommended to adopt the word "knall-gas" into the English language. Cannot we find a word for the explosive mixture of hydrogen and oxygen that possesses a more euphonic sound than "knall-gas," with an English pronunciation?

On comparing the English with the German, numerous questionable translations are immediately revealed. *Verschiedene* and *verschiedenste*, page 311, line 9 from the top, are both translated by *most various*; "*Schüttel-trichter*" by *shaking funnel*, see page 642, line 2 from the top; on page 406, first line from the bottom, "*fremde*" is translated by *strange*, and "*festsetzen*" by *insist*, see page 648, line 15 from the top.

In many cases, especially the latter part of the book, many German words are retained in parentheses, as if the translator was in doubt of their exact meaning. Every German student realizes how difficult it frequently is to find an exact English equivalent; for example, "*zur ersten Orientirung*." Nevertheless, the book was unquestionably intended for English readers; would the best English equivalent therefore not have been better?

Notwithstanding these shortcomings the book will add much to the knowledge of the diligent reader.

LYMAN F. KEBLER.

MONOGRAPH ON FLUID EXTRACTS, SOLID EXTRACTS AND OLEORESINS. WITH APPENDIX. By Joseph Harrop, Ph.G., author of "Monograph on Flavoring Extracts," etc. Edited by Herbert B. Harrop, Columbus, Ohio. Harrop and Company, 1895. 231 pp.

This work demands rather more than passing notice. It illustrates what any pharmacist may do by the application of "will, muscle and mill," and then transferring to paper an account of the experience gained thereby.

The introduction gives a concise statement about weights and measures. Part First is devoted to articles used in the manufacture of medicinal extracts, viz.: Alcohol, water, glycerin, acetic acid, crude vegetable drugs, rice chaff.

Part Second treats of processes. Part Third considers fluid extracts, and gives the method of preparing some 600 of them, which practically covers all that are in the market. Part Fourth, in like manner, is devoted to solid extracts. Part Fifth, oleoresins. Part Sixth, appendix. The author divides the fluid extracts into three classes: (A) When the menstruum is alcohol, (B) when it is diluted alcohol, (C) when it consists of varying proportions of alcohol and

water. Each class is headed by a typical formula, to which the preparations falling under that class are referred. The other classes of preparations are treated in a somewhat similar manner, thereby enabling the large number of formulas to be condensed into a very small space.

The preliminary remarks of the author in reference to each class of preparations are to the point, and we can generally endorse them, except the statement that "the Pharmacopœia is a sealed book," which, we presume, was intended as a kind of apology for printing so many formulas that are already in the Pharmacopœia. No such apology was needed, for there is ample room for such a book as this in addition to our national standard, especially in the field of solvents, where the author might have enlarged considerably. For example, acetone is not mentioned, and it is used very extensively as a solvent at the present time, especially for oleoresins, as pointed out by Beringer (AM. JOUR. PHARMACY, 1892, p. 145). Then, instead of 36 per cent. acetic acid, as mentioned by the author, a 60 per cent. acid is probably more desirable, as shown by Remington (AM. JOUR. PHARMACY, 1893, p. 103). We trust that Mr. Harrop will enlarge on this part of the subject; what is needed is not so much more formulas as more solvents, and the best means of replacing alcohol. We can easily conceive of the whole class of solid extracts being satisfactorily made without the use of one drop of alcohol. We are aware that it has been done by some larger firms by merely subjecting the drug to live steam, but that could hardly yield a satisfactory preparation in many cases.

THE POCKET MATERIA MEDICA AND THERAPEUTICS. A Résumé of the Action and Doses of all Official and Non-official Drugs now in Common Use. By C. Henri Leonard, A.M., M.D. Second edition. The Illustrated Medical Journal Company, Detroit, 1895.

The author states that this book is designed as much for the practitioner as for the student. It can readily be comprehended how the former would find it valuable, but to the student it could not be of much value, except for "cramming" purposes. The descriptions are concise, and a large amount of useful information is condensed into a very small space.

The index is an important feature, covering 68 of the 387 pages in the book.

EXERCISE AND FOOD FOR PULMONARY INVALIDS. By Charles Denison, A.M., M.D., Denver, Col. The Chain & Hardy Company, 1895.

This little work, of 71 pages, is made up of two essays, one on "Exercise for Pulmonary Invalids," and the other, on "Food for Chronic Pulmonary Invalids."

The author has very decided views on these two subjects, but his directions for exercise, as well as for diet, appear more suited to a person in full health than to an invalid. The book should be read, however, by all those who suffer from sedentary habits, and by those predisposed to pulmonary troubles.

EXPERIMENTAL FARMS. Reports to the Minister of Agriculture, Ottawa, Canada, 1895. William Saunders, Director. Pp. 422.

UEBER DIE RINDE und die Blätter von *Drimys granatensis*, L. Von O. Hess. *Liebig's Annalen*, 286, pp. 369.

THE PHARMACAL DIGEST, edited by H. D. Dietrich, Portland, Ore., is the youngest member of the already large family of drug journals. It is published monthly, and will endeavor to give all that is good and of practical

value appearing in the drug journals of the present day, "boiled down, and presented without flowery comment or verbosity of any character."

THE COLLEGE OF PHARMACY OF THE CITY OF NEW YORK. By Prof. H. H. Rusby, M.D. Published by the Faculty. An interesting history of the foundation and development of the New York College of Pharmacy, with a number of illustrations. The first steps towards the foundation of the College were taken in 1829, and a charter was secured in 1831. The objects of its establishment were stated to be "for cultivating, improving and making known a knowledge of pharmacy, its collateral branches of science, and the best mode of preparing medicines and their compounds, and of giving instruction in the same by public lectures."

NORTH CAROLINA PHARMACEUTICAL ASSOCIATION, PROCEEDINGS OF THE SIXTEENTH ANNUAL MEETING, Morehead City, July 10 and 11, 1895.

The following papers are printed in full: *Analysis of Sumac Root*, by E. V. Howell, Ph.G., of Rocky Mount, N. C., and *The Hypothetical Element Phlogiston*, by Augustus Bradley, Ph.G., of Raleigh, N. C.

PROSPECTUS OF THE ST. LOUIS COLLEGE OF PHARMACY. Thirtieth Annual Session, from October 7, 1895, to April 15, 1896.

TWENTY-EIGHTH ANNUAL ANNOUNCEMENT OF THE MONTREAL COLLEGE OF PHARMACY. Session 1895-96.

THE TWENTY-FIFTH ANNUAL REPORT OF THE COUNCIL OF THE PHARMACEUTICAL ASSOCIATION OF THE PROVINCE OF QUEBEC. For the year ending April 30, 1895.

TESTS AND ASSAY PROCESSES FOR SURGICAL DRESSINGS AND BELLADONNA PLASTERS. Reprinted contributions to the pharmaceutical press. From the Seabury Pharmacal Laboratories, New York. 1895.

SCIO COLLEGE, DEPARTMENT OF PHARMACY. Annual Announcement, 1895-96.

ANNUAIRE DE L'ÉCOLE DE MÉDECINE ET DE CHIRURGIE DE MONTREAL, FACULTÉ DE MÉDECINE DE L'UNIVERSITÉ LAVAL DE MONTREAL. 53^{ème} Année, 1895-96.

STATE BOARDS OF MEDICAL EXAMINERS VS. MEDICAL COLLEGES. By Thomas H. Hawkins, A.M., M.D. Reprint from the *Denver Medical Times*.

MINNESOTA BOTANICAL STUDIES, XXIII. A contribution to the bibliography of American algæ. By Josephine E. Tilden. Bulletin No. 9, Part VI, August 26, 1895. Conway MacMillan, State Botanist.

PROCEEDINGS OF THE CONNECTICUT PHARMACEUTICAL ASSOCIATION. Nineteenth annual meeting, held in Norwich, Conn., February 5 and 6, 1895.

PHARMACY. A presidential address by N. H. Martin to the British Pharmaceutical Conference, at the thirty-second annual meeting at Bournemouth, England, July 30, 1895.

THIRD ANNUAL REPORT OF THE TENNESSEE BOARD OF PHARMACY. For the year ending June 30, 1895.

PROCEEDINGS OF THE TENNESSEE DRUGGISTS' ASSOCIATION, at the tenth annual meeting, July 17, 1895.